

## REMARKS

**Claims 1-17 were pending.**

**Claims 1-17 are rejected.**

**Claims 1, 12 and 15 are amended**

### **Amended Claims**

Claims 1 and 15 are amended to replace the term "above 30,000" with "at least 40,000". Basis for this amendment can be found on page 6, line 7.

Applicants have further amended claim 1, to make clear that flocculation with the first flocculant is followed by dewatering or thickening of the suspension. Basis for this amendment may be found on page 5, lines 10-24.

Claim 12 is amended to specify the term "polymer" more clearly by replacing with "cationic organic polymer".

No new matter is added.

### **35 USC 112, second paragraph**

Examiner believes the limitations in claims 9, 10, 12 and 17 appear to be misdescriptive because the Brookfield viscosity recited in claim 1 would appear to have larger intrinsic viscosities.

The applicants bring to the examiner's attention that the intrinsic viscosity recited in the above claims 9, 10, 12 and 17 is a fundamentally different measurement from Brookfield viscosity called for by claim 1.

At the webpage

<http://www.brookfieldengineering.com/education/what-is-viscosity.asp#viscosity>

by the manufacturers of the Brookfield viscometer under the heading viscosity it is explained that viscosity is the measure of the internal friction of a fluid. The fundamental unit of viscosity

measurement is the poise. It is further explained that a material requiring a shear stress of one dyne per square centimetre to produce a shear rate of one reciprocal second has a viscosity of one poise, or 100 centipoise.

According to the entry for intrinsic viscosity (of a polymer) in the IUPAC Compendium of Chemical Terminology shown on the webpage

<http://www.iupac.org/goldbook/I03140.pdf>

intrinsic viscosity is indicated as the limiting value of the reduced viscosity or the inherent viscosity at infinite dilution of the polymer. It is also stated that the units are  $\text{cm}^3 \text{g}^{-1}$  which is in fact the same as dl/g. It is also interesting to note that the document indicates that [intrinsic viscosity] is neither a viscosity nor a pure number.

The difference between solution viscosity and intrinsic viscosity is also made clear in the document at the following webpage

<http://www.chem.uic.edu/chem343/343/Viscosity.pdf>

### **35 USC 103(a)**

The Examiner rejects claims 1 to 3 and 5 to 12 over Weir et al US 7070696 or Sorensen et al US 5846433 in view of Takaki et al US 5292821.

Weir et al describes a process of flocculating and dewatering a suspension of suspended solids by the sequential treatment of a substantially linear polymer and a structured polymer (see Abstract).

The Examiner admits that Weir et al is silent on the second flocculant having the required Brookfield viscosity.

However, Weir et al also does not disclose that the first flocculant brings about thickening of the suspension nor does Weir et al disclose mechanical dewatering to form a cake.

With regard to the essential thickening step of the present invention it is stated on page 4, lines 24 to 26 that the suspension is first thickened following the addition of the first flocculant and it is then explained that thickening involves the initial flocculation and release of water to produce the thickened suspension. It is generally understood by those skilled in the art of solids liquid separation processes that thickening always requires the release of free water.

In column 2, lines 39 to 53 of Weir et al it is indicated that although the second polymer may be added after flocculation has commenced it should be added before the dewatering step or any high shear stage. There may also be some degree of mixing between the addition of the first and second flocculant. Nevertheless there is no suggestion that there should be a thickening stage, that inevitably involves the removal of water, between the addition of the first and second polymers. Furthermore, it is clear from the only example that no thickening stage was employed between the two polymer additions. Therefore it can be seen that Weir et al is completely silent on thickening between the first and second flocculants.

With regard to mechanical dewatering Weir et al makes no disclosure about the type of dewatering employed. In fact in the example, sewage sludge is treated with a first flocculant and a second flocculant and then allowed to drain through a sieve such that free drainage may be measured. Such free drainage is not mechanical dewatering. Weir et al makes no disclosure with regard to mechanical dewatering.

Sorensen et al discloses the treatment of a suspension first with a coagulant and then with a flocculant followed by dewatering to form a thickened sludge or cake (see abstract).

The Examiner also concedes that Sorensen et al does not disclose the second flocculant having the required Brookfield viscosity.

Nevertheless, Sorensen et al also does not disclose a first flocculant but only a coagulant to be added first and further does not disclose a thickening step between the two additives.

With regard to the coagulant as the first treatment aid it is evident from the whole disclosure of Sorensen et al that the terms coagulant and flocculant refer to different entities. Furthermore, in column 6, lines 54 to 69 it is stated that the cationic coagulant can be inorganic such as a salt of a polyvalent metal and even when the coagulant is polymeric it would have very low molecular weight

indicated by intrinsic viscosities of below 3 dl/g and often below 2 dl/g. Such polymers would cause coagulation by charge neutralisation but have insufficient molecular weight that would enable the polymer to perform as a flocculant. This is consistent with the description in Sorensen et al which states that the polymeric flocculant functions primarily by a bridging mechanism (see column 3, lines 64 to 65).

With respect to the thickening stage although Sorensen et al does indeed refer to thickening (see for instance see for instance column 3, lines 16 to 22) within the document, it is the whole process which either results in thickening or mechanical dewatering to produce a cake. Thus the thickening step would be after the flocculant (second additive after the coagulant) and not after the coagulant but before the flocculant.

The Examiner refers to Takaki et al as providing a teaching of a polymer having the required specific Brookfield viscosity.

Takaki et al describes making paper using a cationic acrylamide polymer which has been prepared by reacting an acrylamide polymer with a hypohalogenite under alkaline conditions (see claim 1).

In Takaki et al it is described how to obtain the polyacrylamide and that the viscosity of a 10% aqueous solution should have a Brookfield viscosity of between 100 and 100,000 centipoise. The polymer is said to undergo a Hofmann decomposition reaction which involves the application of the hypohalogenite (see column 6, lines 8 to 20).

The application in papermaking of the thus formed cationic polyacrylamide is described in column 9. It is stated that the solution may also be diluted with water depending on the concentration of the cationic acrylamide polymer after the reaction and that this dilution may be in the order of 0.1 to 10% by weight (see column 9, lines 37 to 43). Therefore the skilled person would interpret this to mean that when the concentration of the polymer is high thereby giving rise to a high viscosity e.g. up to 100,000 centipoise, the polymer should be diluted although it may be unnecessary when the viscosity of the polymer is low e.g. from 100 centipoise. Therefore this document does not disclose addition to the papermaking stock (suspension) of a polymer that has a Brookfield viscosity of at least 40,000 centipoise.

Consequently Takaki et al does not provide any motivation or expectation of success by modifying either of Weir et al or Sorensen et al such that the second additive has the required specific Brookfield viscosity.

Furthermore, Takaki et al provides no guidance in regard to the other deficiencies of either Weir et al or Sorensen et al discussed above.

Consequently, claim 1 and all dependent claims are not obvious over either of Weir et al or Sorensen et al in view of Takaki et al.

Claims 4, 13, 14 and 16 are rejected under 35 USC 1039a) as being unpatentable over Weir et al or Sorensen et al in view of Takaki et al and further in view of Ghafoor et al.

Ghafoor et al describes a stable, pourable, liquid composition comprising a dissolved low IV cationic coagulant, a dissolved inorganic salt and a dispersed water-soluble high IV polymer in which the liquid composition has a Brookfield viscosity of less than 30,000 centipoise (see claim 1). Ghafoor et al also discloses adding the composition to a suspension in order to flocculate and/or coagulate suspension (see claim 14).

However, the composition of Ghafoor et al must have a Brookfield viscosity of less than 30,000 centipoise. There would be no reason why the skilled person would choose to provide a process in which a second flocculant would have a Brookfield viscosity of at least 40,000 centipoise. Therefore in addition to the deficiencies already identified in Weir et al, Sorensen et al, and Takaki et al claims 4, 13, 14 and 16 would not be rendered obvious over the additional disclosure of Ghafoor et al.

With regard to the rejection of claim 15 over Takaki et al as stated before, this reference does not disclose addition of a polymer having the specified Brookfield viscosity to the suspension to be dewatered. Consequently, Takaki et al does not render claim 15 as amended obvious.

### **Double Patenting**

Claims 1-17 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-14 of co-pending Application No. 10/591,776.

Applicants respectfully request to put off addressing this rejection until the limitations of the allowed claims are known. At that time, applicants can better determine the suitability of the present double patenting rejection.

Reconsideration and withdrawal of the rejection of claims 1-17 is respectfully solicited in light of the remarks and amendments *supra*.

Since there are no other grounds of objection or rejection, passage of this application to issue with claims 1-17 is earnestly solicited.

Applicants submit that the present application is in condition for allowance. In the event that minor amendments will further prosecution, Applicants request that the examiner contact the undersigned representative.

Respectfully submitted,



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